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DONATIONS.

Journal of the Royal Asiatic Society. No. XI. Presented by the Society.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. Premier Semestre, 1840, Nos. 13—19, and Index. Presented by the Institute.

A Quern, Fragments of Pottery, and Animal Remains, found on Roughan Island. Presented by Wm. Pike, Esq.

A Letter to the President of the Royal Irish Academy, in reply to certain Charges made against George Petrie, Esq. Presented by the Author.

A Manuscript Copy of Keating's History of Ireland, by Andrew M'Curtin, dated at Ibrickan, County of Clare, A.D. 1703. Presented by Richard Carmichael, Esq.

A bronze Axe. Presented by the same.

June 22.

SIR WM. R. HAMILTON, LL.D., President, in the Chair.

The Rev. Dr. Todd continued his account of the contents of the Book of Lismore.

The tracts next in order in this volume are legends of ecclesiastical history,—as the legend of the venerable Bede; of St. Petronilla, the daughter of St. Peter; of the discovery of the Sybilline Oracle, in a stone coffin at Rome; of St. Gregory the Great; the heresy of the Empress Justina. Then follow tracts on the origin of some of the minor ceremonies of the mass; an account of the successors of Charlemagne; the controversy of Archbishop Lanfranc with the Romans, about Transubstantiation; a battle between the priests of Rome and the devil; extracts from the voyage of Marco Polo, translated into Irish; a very ancient tract on the wars of the celebrated Callaghan Cashel, King of Munster, with the Danes, in the tenth century; a romantic tale, entitled, The Adventures of Teige, the son of Cian, the son of Oilliol Olum, King of

Munster; an account of the battle of Crionna, between Cormac Mac Art and the Ultonians; the adventures of Laoghaire, son of a King of Connaught, with the fairies; the manner in which Connor Mac Nessa, son of a Druid, obtained the crown of Munster; a very curious historical tale, entitled, The Seige of Druim Damhghaire, now Knocklong, in the County of Limerick. This tale is of great importance, from its undoubted antiquity, and the topographical descriptions which it contains of the country about Fermoy, in the County of Cork.

The last tract in the MS. is one of very great interest: it is in the form of a dialogue between St. Patrick and the two survivors of Fiana Eireann,—Caoilte Mac Ronain and Oisin, son of Finn Mac Cumhail. It describes the situation of several hills, mountains, rivers, caverns, rills, &c., in Ireland, with the derivation of their names. It is much to be regretted, that this very curious tract is imperfect, especially as no other copy of it is known to exist. But for these defects we should probably have found in this tract notices of almost every monument of note in ancient Ireland: and, even in its present mutilated state, it cannot but be regarded as preserving the most ancient traditions to which we can now have access,—traditions which were committed to writing at a period when the ancient customs of the people were unbroken and undisturbed.

Rev. H. Lloyd, V.P., gave an account of a series of observations of the Magnetic Declination, made by Professor Bache of Philadelphia and himself, in the hope of determining thereby differences of longitude.

It is well known that the magnetic declination, at a given place, is subject to frequent and irregular variations, and that corresponding changes occur, at the same instant of time, at very distant places. The first recognition of this remarkable phenomenon seems to have been made by Arago, while comparing the observations of declination made by himself, at Paris, in the year 1818, with the contemporaneous observations of M. Kupffer, at Casan. Not long after, the subject underwent a fuller investigation in the hands of Humboldt; and, in the year 1827, an extensive system of simultaneous observations was organized by that illustrious philosopher for the purpose of elucidating it. At length, in 1834, it was taken up by Gauss, and received a much greater development. Gauss discovered that the irregular changes of the declination were of *continual* occurrence; and that the synchronism, which had been previously observed only in the larger changes, extended to the minutest movements. In order to investigate the law of these synchronous changes, and the locality and other circumstances of the acting forces, Gauss arranged the extensive plan of simultaneous observations at short intervals, which has been already four years in operation, and in which almost every country in Europe has been represented by some one or more observers.

Having taken part in this combined system in the year 1837, Prof. Lloyd was led to inquire, in the first place, whether this irregular fluctuation of the declination might not be still more rapid than appeared from the observations hitherto made; and, secondly, whether these shorter oscillations (if they existed) corresponded in distant places, and could therefore be employed to determine differences of longitude.

To investigate the first of these questions, a series of observations was made in the month of September, 1837, at very short intervals. The instrument employed was Gauss's magnetometer; and the magnet being in a state of continued vibration, observations were taken at each succeeding maximum elongation, and therefore at the interval of a single oscillation,—which, in the case of the bar employed, was $27^s.38$. The mean of each successive pair of readings was then taken, to eliminate the mechanical oscillation, and the results projected in curves in the usual manner. On an examination of these curves it appeared, as had been anticipated, that the maxima and minima of the irregular movements usually succeeded each other with very great rapidity, their interval being, on the average, about 40 seconds, and their magnitude varying in these observations from 10″ to 60″.

The observations were resumed on the 23rd of October, and continued to the 26th, two series of an hour's duration being made each day, in the hope of detecting some law governing the movements. No such law however could be traced, nor did there appear to be any connexion between the curves representing the march of the changes, at different hours of the same day, or at the same hour on successive days.

The observed variations in these observations being small, it was suggested by an experienced friend, to whom Prof. Lloyd showed the results, that they were not true magnetic changes, but merely the errors of observation incidental to vibratory movement. In order to test this supposition, an unmagnetic bar (the brass detorsion bar of Gauss's apparatus) was substituted for the magnet, to which it corresponded in dimension; and being provided with a mirror, was suspended by two parallel threads, and made to vibrate. The time of vibration was adjusted, by varying the interval of the threads, so as to differ little from that of the magnet. The successive elongations were then observed, as in the case of the magnet, and the means of each pair taken. The variations in these means (which could arise from errors of observation or mechanical changes only) bore no comparison whatever in magnitude to the corresponding variations of position of the magnetic bar, thus showing that the latter were truly the results of the operation of magnetic forces.

The rapidity with which these changes thus appeared to follow each other, held out the hope that they might be employed in determining differences of longitude; and it only remained to ascertain, for that purpose, whether variations so inconsiderable in magnitude corresponded at great distances. If such should prove to be the fact, it would be only necessary to project on a large scale the results of the observations made about the same absolute time at the two stations, and to compare the times of the corresponding maxima and minima. In the observations already referred to, the maxima and minima succeeded each other (as has been said) at intervals of about forty seconds, and the epoch of their occurrence was probably known to six or seven seconds. By shortening still further the interval of observation, it is manifest that this error may be much diminished. The corresponding error of the difference of longitude resulting from a single comparison (supposing the probable error of epoch to be the same at the two places,) will be greater in the ratio of $\sqrt{2}$ to 1; but this error, owing to the multitude of the maxima and minima compared, must necessarily be greatly reduced in the final mean.

In order to put this question to the test on the largest scale, it was agreed between Mr. Bache and Mr. Lloyd, to make a series of corresponding observations in Philadelphia and in Dublin. Some difficulties occurred in concerting a plan, and Prof. Bache underwent, in one instance, the labour of an extensive series of observations, without any counterpart in Dublin. At length, however, it was agreed to observe during the week commencing the 11th of November, 1839; the observations being taken during two hours on each day—namely, from 12 to 1 P.M., and from 8 to 9 P.M., Greenwich mean time.

Prof. Bache's account of his observations is contained in the following extract of a letter which accompanied them, dated November 29, 1839.

" The place of observation is a room in one of the out buildings for the dwellings of the Professors of the Girard College. As the materials used in the construction of the house must produce considerable local attraction, no absolute measures have been attempted. All moveable magnetic substances were removed from the vicinity of the needle. A window near the needle was carefully closed by a shutter of wood, and by two curtains fastened to the window frame, and with an interval between them. There is no fire in the room; and a double door is between the observing room and an adjoining one where there is a fire.

"The instrument is one of Gauss's declination magnetometers, made by Meyerstein of Gottingen. The arrangement of it agrees exactly with that described in the *Resultate*, which has been followed as nearly as possible. The reading telescope is supported upon a small wooden shelf fastened to one of the side walls of the room; the scale is attached to a wooden frame before the shelf. One of the smallest divisions of the scale, which is divided by estimation in the observations to tenths, is $25''{\cdot}975$ nearly in value. The zero of the scale did not vary sensibly in position during the observations.

"The observations were made every eight seconds, an assistant striking two seconds before the time of each observation. The ticks of the half-seconds chronometer being distinctly audible, the observation was made at the fourth beat after the signal given by the assistant, and thus the time was independent of the minute accuracy of the signal. Checks were adopted to prevent or detect large errors in giving the signal. The interval of eight seconds is very nearly one-third of the time of oscillation of the magnet bar.

"The time was observed by a chronometer beating half seconds. This was compared before and after each set of magnetic observations with one, and after the morning of the 14th with two chronometers. One of these was carried from the Girard College to the city after each set of observations; but the others remained during the night at the Girard College, and were removed to the city after the morning series, to compare them with the stationary chronometer belonging to the High School Observatory, the rate of which was ascertained by observations of transit of the sun and stars on the 6th, 9th, 11th, 13th, and 16th of November. Girard College is about 1770 feet west, and 8050 north of the High School by the city map."

The Dublin observations were made in the Magnetical Observatory. The instrument employed is of the form described some time since to the Academy.* It is a magnetic collimator with a graduated scale of glass, each division of which corresponds to $43''{\cdot}22$ of arc. The visual angle under which each division is seen is so considerable, that the divisions can readily be subdivided into tenths by estimation. The time of vibration of the magnet is $17^{s}{\cdot}78$. The apparatus containing the magnet, as well as the reading telescope, are supported on stone pillars resting on solid masonry, and insulated from the floor.

The observations having been undertaken by Prof. Lloyd without assistance, it was found impracticable to observe at intervals shorter than the time of vibration of the magnet bar, of which each successive elongation was accordingly noted. The time shown by the chronometer was usually noted every tenth or twelfth vibration; and thus the time of the intervening observations could be interpolated with much exactness. The error of the chronometer was obtained on the nights of the 11th, 14th, and 19th of November, by transit observations with the four-foot transit of the Observatory.

Of these observations, those made on Wednesday, Nov. 13, (8—9) P. M. Greenwich mean time, were the most favourable for the purpose contemplated. The changes, though small, (from $5''$ to $50''$,) were marked and rapid, the intervals of the successive maxima and minima averaging thirty-six seconds. The epoch of their occurrence seems to be determinable to between four and five seconds.

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* See Proceedings, No. 18, p. 330, *et seq.*

When the two sets of observations were reduced and laid down in curves, it was found that they presented no similarity; in other words, that there was *no correspondence whatever between the smaller changes of the declination at Dublin and at Philadelphia.* The determination of differences of longitude, by means of the magnet, is, therefore, impracticable at such distances; but the attempt has revealed the important fact, that the irregular changes of declination, which have exhibited so marked a correspondence at the most distant stations at which simultaneous observations have been heretofore made, do not correspond on the American and European Continents. Prof. Lloyd observed that much light would, erelong, be thrown upon this curious subject, by a comparison of the observations made at the Magnetical Observatory of Toronto, in Upper Canada, with those of Europe.

A Paper "on the Cooling Power of Gases," by Thomas Andrews, M.D.,M.R.I.A., was read by Dr. Apjohn.

Leslie observed, long ago, that a heated body cools more rapidly in hydrogen gas than in atmospheric air; but Dalton and Davy were the first who attempted to estimate the cooling powers of the gases, by observing the times which a thermometer, heated to the same point, took to cool through the same number of degrees in different gases. So difficult of execution, however, is this method, that their results differ, in every respect, most widely from each other: thus, for example, Davy found that a thermometer cooled twice as fast in olefiant gas as in nitrous oxide, while Dalton found the rate of cooling in both these gases to be the same.

The subject appeared to be deserving of further investigation, and the author has endeavoured to pursue it by a novel method, which may, perhaps, be susceptible of other applications in inquiries connected with the science of heat.

When a fine metallic wire is placed in the circuit of a voltaic circle, it is well known that it will become heated, and the temperature which it finally acquires (provided the length of the wire remain the same, and the action of the battery continue constant) will depend upon the cooling power of the medium in which the wire is placed. If the current be of sufficient intensity to heat the wire to redness in air, the variations in its appearance, when placed in other gases, will exhibit, at a glance, their relative cooling powers. But, since the conducting power of wires for electricity diminishes as their temperature rises, a measure of the effect may be obtained by ascertaining the changes produced in the intensity of the current, which will increase or diminish, according to the greater or less cooling power of the medium in which the wire is placed.

The battery, employed in the following experiments, consisted of four large cells, on Daniell's construction, charged with his standard solutions; and of a small cell, composed of an exterior cylinder of amalgamated zinc, and an interior plate of platina, the latter being separated from the former by a cylindrical membrane, and both immersed in dilute sulphuric acid. The hydrogen gas, disengaged from the platina plate, was collected in a graduated tube, and its volume taken as a measure of the intensity of the current. A platina wire, about 2·5 inches long, and $\frac{1}{120}$ in diameter, was stretched in the middle of a wide glass tube, by means of copper pincers, which were connected by thick wires of the same metal with the poles of the battery. The glass tube was so adjusted as to be easily traversed by a current of gas, which afterwards escaped from beneath a surface of mercury, and the connecting wires being passed through collars of caoutchouc, the whole apparatus was rendered perfectly air-tight.

In making the observations, a current of the gas, carefully dried, was passed in great excess through the apparatus, in order to sweep away, as completely as possible, the atmospheric air; the current was then arrested, and, the connexions with the battery being established, the appearance presented by the heated wire was noted, and the intensity of the current transmitted through it ascertained by collecting the hydrogen evolved in the small cell during the space of two minutes. The gas was next displaced by a current of dry air, and the same experiment repeated. During these experiments the battery was always in a very constant state of action. The results are contained in the following table, in which the second column gives the quantity of hydrogen extricated at each experiment with the wire in air; the third with the wire in the gas; and the fourth column expresses the ratios of these numbers—those in the second being taken as unit:—

Name of Gas.	Intensity. Wire in air.	Intensity. Wire in gas.	Ratio of Int. that in air=1.
Muriatic acid, . . .	65·9	63·1	0·958
Sulphuric acid, . . .	69·2	66·9	0·967
Nitrogen, ...	67·3	67·	0·995
Carbonic oxide, . . .	68·1	68·3	1·003
Cyanogen, ...	66·3	67·	1·010
Carbonic acid, . . .	66·6	67·5	1·013
Deutoxide of nitrogen,	66·2	67·3	1·016
Protoxide of nitrogen, .	68·3	69·6	1·019
Oxygen, ...	68·3	69·6	1·019
Olefiant gas, ...	68·2	76·2	1·171
Ammonia, ...	67·4	75·3	1·118
Hydrogen, ...	67·0	92·6	1·382

As, however, the law, which connects the intensity of a voltaic current traversing a wire with the temperature to which it raises the wire, is unknown, these numbers do not furnish us with the means of determining the exact variations of temperature, sustained by the wire which was employed in these experiments. But, as a term of comparison, it may be mentioned that, when the wire was immersed in distilled water which prevented its temperature from sensibly rising, the intensity of the current was almost exactly twice as great as when the wire was allowed to become heated, in atmospheric air at the ordinary pressure.

The appearances presented by the platina wire corresponded with the foregoing results. In atmospheric air, it exhibited a bright red heat; in the muriatic and sulphurous acid gases, the redness was distinctly a shade brighter; in cyanogen, carbonic oxide, and hydrogen, there was no sensible difference; in carbonic acid, oxygen, and the deutoxide of nitrogen, the wire, so far as the eye could judge, appeared rather duller than in air; while, in olefiant gas and ammonia, it was only raised to a very obscure red heat, and in hydrogen, no redness whatever was visible, even in complete darkness. This method may, it is obvious, be extended to vapours; and, from some trials made with them, it appeared that the cooling powers of the vapours of alcohol and ether are considerably greater than the cooling power of air, and that of steam very slightly greater. On the other hand, the cooling power of all gases diminishes as they become rarefied; so much so, that the platina wire used in the preceding experiments reached in vacuum nearly its point of fusion, while, at the same time, the intensity of the current considerably diminished.

The gases may be conveniently arranged into the following groups, in reference to their cooling powers; and it will be found, on inspecting the table, that those arranged in each group differ little in this property from each other:—

Group I. Gases whose cooling power is less than that of atmospheric air:—sulphurous acid, muriatic acid.

Group II. Gases whose cooling power is nearly the same:—nitrogen, carbonic oxide, cyanogen, carbonic acid, deutoxide of nitrogen, protoxide of nitrogen, oxygen, vapour of water.

Group III. Gases whose cooling power is greater:—olefiant gas, ammonia, vapours of alcohol and ether.

Group IV. Hydrogen.

Dr. Apjohn next drew the attention of the Academy to a metallic ore recently found at the Kilbricken Lead Mine, County of Clare, which he had received through a friend from Mr. M. Taylor, the gentleman who conducts the mining operations in that district. It occurs in amorphous masses of a bluish grey colour; has a metallic lustre, and something between a compact earthy and close foliated structure. Specific gravity =6·407; hardness intermediate between that of galena and sulphuret of antimony. Subjected to the action of the blowpipe sulphur is burned off; white oxide of antimony is deposited upon the charcoal; and a metallic globule is produced, brittle at first, but which becomes malleable lead after having been submitted for some time to the action of the oxidating flame. In muriatic acid the ore dissolves, though slowly, with the evolution of sulphuretted hydrogen; and the solution, when poured into a large quantity of boiling water, gives a white precipitate (oxichloride of antimony.) When this precipitate has subsided, the solution is found to contain nothing but chloride of lead, with traces of antimony and iron. From these experiments the mineral was concluded to be a combination of sulphur, lead, and antimony; and to determine the proportions in which they were associated, the following analytic process was adopted.

44·52 grains of the ore, previously reduced to a fine powder, were introduced into a ball, blown upon a tube of Bohemian glass; and through this a current of dry chlorine was made to pass, the arrangement of the apparatus being such, that by a rectangular bend in the portion of the tube beyond the ball, the chlorine was made to bubble through a dilute solution of tartaric acid. This acid was placed in a tall flint-glass bottle with narrow neck, the mouth of which was closed (but not air tight) by a cork which was perforated so to receive the vertical arm of the bent tube. Upon contact of the chlorine and ore considerable heat was developed. When, the current of gas being still maintained, this began to subside, a lighted spirit lamp with circular wick was placed beneath the ball, and its flame gradually augmented so as to expel the chlorides of sulphur and antimony, and finally to fuse the chloride of lead; and a smaller spirit flame was at the same time made to play on the tube beyond the ball, so as to cause the volatile chlorides to pass into the tartaric acid, or at least into the vertical portion of the tube whose further extremity was immersed in the acid solution. The tube was now nicked with a file, and broken across at its point of flexure; and the portion not connected with the ball was subjected to a stream of distilled water, so as to wash any chlorides which it might include into the bottle containing the tartaric acid. This portion of the tube was now heated to redness, so as to render it perfectly dry, and then weighed along with the remaining fragment on which the ball was blown, and which contained the chloride of lead. The weight of this chloride was thus obtained; being obviously equal to the weight last obtained, diminished by the weight of the ball and tube. It was thus found to amount to 40·96 grains, equivalent to 30·52 of metallic lead. The remaining constituents of the ore were now in the tartaric acid, the sulphur being partly in the free state, but chiefly in the form of sulphuric acid. The free sulphur was first separated, and found to weigh 0·1 grain. To the acid solution chloride of barium was added, which threw down the sulphuric acid in the form of sulphate of barytes. This, when well washed, dried, and ignited, weighed 51·87 grains, equivalent to 7·15 sulphur; hence $7{\cdot}15 + 0{\cdot}10 = 7{\cdot}25$ is the total amount of the sulphur.

Sulphuric acid was next added, to precipitate any excess of barytes; and, this being separated by filtration, sulphuretted hydrogen was passed through the solution, which threw down the antimony as orange tersulphuret. The vessel being placed upon the sand bath for about an hour, so as to expel any excess of sulphuretted hydrogen, the precipitate was collected on a filter, and exposed for a considerable time to a temperature not exceeding 212°. Being thus rendered perfectly dry, it was found to weigh 8·85 grains, equivalent to 6·37 metallic antimony.

The solution from which the antimony was separated was supersaturated with ammonia, and sulphuretted hydrogen was again passed through it, which threw down the iron; upon this precipitate nitro-muriatic acid was digested, and the unacidified sulphur being separated by a filter, the acid solution was supersaturated with ammonia, which threw down peroxide of iron, weighing, when ignited, 0·244 grains, equivalent to 0·17 grains of iron. The following, therefore, are the results of the analysis:

Sulphur	7·25
Lead	30·52
Iron	0·17
Antimony	6·37
Loss	0·21

100 parts therefore of the ore consist of

	(1)	(2)	(3)	(4)
Sulphur	16·36	1·016	1·016	9·153
Lead	68·87	0·664	0·677	6·099
Iron	0·38	0·013		
Antimony	14·39	0·111	0·111	1·000
	100			

The numbers in column (2) are the quotients obtained by dividing the corresponding ones in column (1) by the atomic weights of the substances they represent. The numbers in column (3) are the same as those in (2), with the exception that the quotients for the lead and iron are added together. In (4) we have other numbers in the same ratio as the preceding. A mere inspection of the latter is sufficient to show that the empirical formula of the mineral is $S_9\, Pb_6\, Sb_1$; and such being the case, there can be no doubt that the rational formula is

$$6\ (S,\ Pb) + S_3,\ Sb,$$

or that it consists of six atoms of sulphuret of lead associated with one atom of tersulphuret of antimony, a little of the former metal being replaced by an equivalent quantity of iron.

The above are the particulars of the analysis which appeared on the whole to have been most successfully performed; the analysis, however, was repeated three times, and the results in each instance conducted to the formula just given. In the first trials, in consequence of strongly heating the ball traversed by the chlorine from the very commencement of the experiment, some of the chloride of lead was volatilized, and Dr. Apjohn was led to conclude the constitution of the mineral to be materially different from what it afterwards proved to be. The ball should not be heated until the spontaneous action of the chlorine on the ore has ceased.

Kilbrickenite, as Dr. Apjohn proposed to call this mineral, is obviously what Berzelius denominates a sulphur salt, i. e., a combination of an electro-negative with an electro-positive sulphuret. But there are several other ores known to mineralogists composed of the same proximate constituents, or including sulphuret of lead in association with the sulphuret of antimony. The subjoined list comprehends those which have been analysed and described.

Zinkenite	$S, Pb + S_3, Sb$.
Plagionite . . .	$4 (S, Pb) + 3 (S_3, Sb)$.
Jamesonite . . .	$[5 (S, Pb) + S_3, Pb_2] + 4 (S_3, Sb)$?
Feather ore of lead	$2 (S, Pb) + S_3, Sb$.
Boulangerite . .	$3 (S, Pb) + S_3, Sb$.

A mere inspection of the formulæ is sufficient to show that each mineral in this list is distinct in composition from that whose analysis has been given above. There is, however, an ore possessing a constitution perfectly analogous to the Irish mineral—namely, the *sprödglaserz* of Mohs and Werner, or what Dr. Thomson calls *brittle silver glance*. The formula of this mineral Rose has shown to be $6 (S, Ag) + S_3, Sb$; so that it differs from *Kilbrickenite* merely in containing silver instead of lead.

The following note—"On a principle for producing an everburning Flame," by George J. Knox, Esq., was read by the Secretary:

"A belief in the discovery of an everburning lamp appears to have been prevalent in all ages; and tradition informs us that lamps have been found in tombs, where they have continued burning for upwards of 1000 years, of which mention has been made in the works of St. Austin, Plutarch, Pliny, Ludovicus Vives, Baptista Porta, and Licetus. The Rosecrucians,* who laid claim to the knowledge of everything mysterious, pretended to have rediscovered the secret of their construction, which was supposed to have been buried in the tomb of their founder. Dr. Plott,† in a treatise which he has written upon this subject, alludes to a lamp mentioned by St. Austin in his book *de Civitate Dei*, which was hung up in the temple of Venus; and to another found in the tomb of Pallas the Arcadian, who was slain by Turnus in the Trojan war, which continued to burn after its removal from the tomb and exposure to the air—proving that these lamps were not supplied from any bituminous source, or volcanic fire. He considers the requisites for an everburning lamp to be,—a perpetual wick, which might be made of gold wire, or asbestus; and a perpetual supply of fuel, which he imagines the bituminous springs of Pitchford, in Shropshire, or the inflammable gases issuing from fissures in coal mines, would afford. That such could supply fuel for a flame, so long as the bituminous spring existed, or the gas continued to exhale from the mines, is evident; but it no more deserves the appellation of an everburning lamp, than does a fire arising from any volcanic source. The desideratum for such a lamp is, that it should contain, within itself, a *renovating* principle, such as, probably, does the luminous atmosphere encompassing the body of the sun, supposed by Sir William Herschel to be electrical.

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* Spectator, vol. v. No. 379.

† Lowthorp's Abridgment of Phil. Trans. vol. iii. (636).

"That electricity was the principle upon which such a lamp could be constructed having occurred to me some years ago, I reflected upon the different means by which a constant light could be produced from this source, and concluded that, if by an arrangement of metals a thermo-electric current could be produced of sufficient intensity to decompose water, the heat produced by the burning of the two gases arising from the decomposition, would be sufficient, when applied to the alternate metallic junctions, to continue the electrical current of the thermo-electric pile; while the gases, which in burning become aqueous vapour, might be condensed by passing through a long tube, through which being conveyed to the closed vessel in which the water had been originally placed, they would again undergo decomposition, recombination, and condensation. Such a thermo-electric arrangement has been discovered by Prof. Botto of Turin, who has obtained decomposition of water from a series composed of a great number of wires of platinum and iron. To prevent the apparatus from acquiring in time the same temperature, the alternate junctions of the metals, to which the heat is not applied, might be connected with the pedestal upon which the lamp is placed; and the pedestal be either allowed to rest in a cold situation, or else be connected by wires with some extensive cooling surface."

The President gave an account of some investigations respecting *Fluctuating Functions,* from which the following are extracts:—

"Let P_x denote any real function x, continuous or discontinuous, but such that its first and second integrals,

$$\int_0^x dx\, P_x, \text{ and } \left(\int_0^x dx\right)^2 P_x,$$

are always comprised between given finite limits. Let also the equation

$$\left(\int_0^x dx\right)^2 P_x = \mu,$$

in which μ is some given constant, have infinitely many real roots, both positive and negative, which are not themselves comprised between any finite limits, but are such that the interval between any one and the next greater root is never greater than some given finite interval. Then,

$$\lim_{t=\infty} \int_a^b dx \int_0^{tx} dy P_y\, F_x = 0, \qquad \text{(A)}$$

if a and b are any finite values of x, between which the function F_x is finite.

"Again, the same things being supposed, let the arbitrary function F_x vary gradually between the same values of x; and let P_x be finite and vary gradually when x is infinitely small; then

$$F_y = \varpi^{-1} \int_0^\infty dt \int_a^b dx\, P_{tx-ty}\, F_x, \left(y {> a \atop < b}\right), \qquad \text{(B)}$$

in which

$$\varpi = \int_{-\infty}^{\infty} dx \int_{0}^{1} dt \, \mathrm{P}_{tx}.$$

"For the case $y = a$, we must change ϖ, in (B), to

$$\varpi' = \int_{0}^{\infty} dx \int_{0}^{1} dt \, \mathrm{P}_{tx};$$

and for the case $y = b$, we must change it to

$$\varpi'' = \int_{-\infty}^{0} dx \int_{0}^{1} dt \, \mathrm{P}_{tx}.$$

"For values of $y > b$, or $< a$, the second member of the formula (B) vanishes.

"If F_x, although finite, were to receive any sudden change for some particular value of y between a and b, so as to pass suddenly from the value F'' to the value F', we should then have, for this value of y,

$$\int_{0}^{\infty} dt \int_{a}^{b} dx \, \mathrm{P}_{tx-ty} \, \mathrm{F}_x = \varpi' \, \mathrm{F}' + \varpi'' \, \mathrm{F}''.$$

By changing P_x to cos x, we obtain from (B) the celebrated theorem of Fourier. Indeed, that great mathematician appears to have possessed a clear conception of the *principles* of fluctuating functions, although he is not known to have deduced from them consequences so general as the above.

"Again, another celebrated theorem is comprised in the following:—

$$\mathrm{F}_y = \varpi^{-1} \, \mathrm{P}_0 \left(\int_{a}^{b} dx \, \mathrm{F}_x + \Sigma_{(n)1}^{\infty} \int_{a}^{b} dx \, \mathrm{Q}_{x-y,n} \, \mathrm{F}_x \right), \qquad \text{(C)}$$

in which, the function Q is defined by the conditions

$$\mathrm{Q}_{x,n} \int_{0}^{x} dx \, \mathrm{P}_x = \int_{2nx-x}^{2nx+x} dx \, \mathrm{P}_x;$$

y is $> a$, $< b$; and no real root of the equation

$$\int_{0}^{x} dx \, \mathrm{P}_x = 0,$$

except the root 0, is included between the negative number $a-y$ and the positive number $b-y$, nor are those numbers themselves supposed to be roots of that equation. When these conditions are not satisfied, the theorem (C) takes other forms, which, with other analogous results, may be deduced from the same principles."

Mr. Petrie exhibited an ancient Irish consecrated bell, recently obtained by the Dean of St. Patrick's, and which had been for many generations in the possession of a family named Hanan, or O'Hanan, in the county of Armagh. This bell is of the usual quadrangular form, in use amongst the Irish from the introduction of Christianity into the country till the close of the eleventh century, but has an approximation to the round form which became general after the latter period. The age of this bell can be determined with perfect accuracy, from the following inscription in the ancient Irish character which is carved upon it.

+ O̅R̅ aꞃ Cumaꞅcach m̅c̅ Aılılla,

or "Pray for Cumuscach the son of Ailill."

The death of this Cumuscach, who was Economist of the Cathedral of Armagh, is recorded in the Annals of the Four Masters at the year 904. His mother, who was named Gormlaith, was a daughter of Murdach King of Ulster.

The Academy then adjourned to Monday the 9th of November.

DONATIONS.

Archaeologia. Vol. XXVIII. Presented by the Society of Antiquaries of London.

Transactions of the Zoological Society of London. Vol. II., Parts 1, 3, 4, and Proceedings, Nos. 4, 5, 6, 7. Presented by the Society.

Cambridge Astronomical Observations for the Year 1838. By the Rev. James Challis, M.A. Presented by the Author.

Annual Report of the Maitland Club for 1840. Presented by John Smith, Esq.

A Letter to Sir W. R. Hamilton, by Sir Wm. Betham. Presented by the author.

An Essay on the Study of the Celtic Languages, by A. B. Chapin, M.A. Presented by the Author.

Two Gold Fibulæ, found at Castlebar, and purchased by Subscription. Presented by the Subscribers.